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Soldering

This month Colin Redwood G6MXL turns his attention to soldering.

Fig. 1: A 25W soldering iron from Antex.

Soldering is a fundamental skill that just about every radio amateur needs to master. Indeed, it is seen as such a fundamental part of the hobby that the syllabus for the Intermediate Licence includes soldering and other construction skills. Even if you don't build your own transmitter or receiver, some basic soldering skills are needed to set up most amateur radio stations for such things as antennas, feeders and their PL259, BNC and N connectors. You may also need to make up leads to connect data interfaces to computers and transceivers so that you can enjoy making contacts using popular data modes such as PSK31, RTTY and Slow Scan Television (SSTV). While much of what I will be describing will also apply to small surface-mount components, this month I am confining my attention to traditional components with leads and connectors.

Fig. 2: Thin multi-core solder.

Which Soldering Iron?

There is a wide range of soldering irons available. The ones that plumbers use are certainly not suitable for most amateur radio purposes. The ones we need come with a fine tip that is suitable for soldering electronic components. Over the years I've come across a number of soldering irons that, unfortunately, are not powerful enough for our purposes. I think the 25W irons from Antex are really excellent, **Fig. 1**. 25W is sufficient to provide enough heat for nearly all our purposes. Please don't be tempted with a more powerful iron because you may overheat and damage temperature sensitive components. Antex have a range of bit sizes to suit any solder joint you might wish to make and they also have soldering iron stands and replacement bits.

Which Solder?

Just as there is a wide range of soldering irons on the market, there is also a wide variety of solders. You need to avoid the thick chunky solder used by plumbers. Look for a thin solder with built-in flux, often sold under the brand name Multi-core, **Fig. 2**. Traditionally, solder was a mixture of lead and tin. In our more environmentally aware times other materials are used, some of which have a slightly higher melting point than traditional materials. Make sure that the soldering iron you buy is designed to properly melt the type of solder you use.

Safety

Before continuing, it is important to consider safety when soldering. Soldering irons get very hot when in use, more than enough to burn you. So don't touch the tip or any of the metalwork. You should only hold the iron by the handle, which is usually made of plastic. Don't be tempted to see if the iron is warming up by touching the metal parts! Hold the iron as if you were holding a pen when writing, not like you'd hold a screwdriver. Don't forget to use a proper soldering iron stand – you don't want to burn the table where you are working. If you should burn yourself, put the soldering iron down in its stand, disconnect the power to the iron and immerse the burnt area in clean cold water as quickly as you possibly can. If you are in any doubt, I would suggest getting an experienced amateur to supervise your first attempts.

Fumes

When solder is heated so that it melts, it gives off fumes. While the amount of fumes produced is quite small, they can accumulate with time, so make sure that you solder in a well-ventilated place. Indoors with a window open is a good idea. I try to avoid soldering outdoors, particularly during the winter, because everything to be soldered is so much colder than indoors and any wind is likely to have a cooling affect. Moving to a shed or garage in winter, particularly when soldering connectors to feeder, can help overcome the cold. No matter where you solder, try not to lean in closer than is necessary to see what you are doing.

Fig. 3: Goggles to protect eyes from solder splashes.

Eye Protection

Don't forget your eyes. You should certainly wear some eye protecting goggles, **Fig. 3**. Occasionally some molten solder can splash up into the air. I find this is more likely to happen when removing components from a printed circuit board (PCB) or if there is some moisture present (perhaps with a recently washed board). You'll also be glad of some eye protection once you have made the joint and need to snip off the remaining component lead. Sometimes these can be particularly tough to cut and then fly in any direction!

Warming Up

If your soldering iron stand has a sponge, make sure that you soak it in water before you start soldering so that it is really wet. Plug the soldering iron into the power source and wait for it to really warm up. It will take a few minutes to reach operating temperature. After a few minutes, dab a bit of solder on the tip. If it doesn't melt immediately, then it isn't hot enough so wait a few more minutes. Once it is good and hot, you'll need to tin the tip by dabbing a little solder onto the tip and allowing it to flow around the surface of the tip. Don't overdo this – we just need to get a shiny surface on the tip. Tinning is really important because it helps transfer the full heat of the iron to the joint you are soldering. At any stage, if there is too much solder on the tip of the iron, you can wipe the excess off on the wet sponge.

Making a Soldered Joint

I am going to assume that the first soldered joints you are going to make are soldering traditional (not surface mount) components with leads into a PCB. The same will also apply to components being soldered into strip-board such as Veroboard.

Fig. 4: Wire wool.

Preparation

Both items being joined must be clean. This means that there is no oxidised layer on either the component or the PCB. PCBs that have been stored for any period of time are likely to have an oxide layer on the surface of the copper. The copper on PCBs needs to be really shiny. If you have any doubts, a light scrub with some wire wool will soon remove any oxide. While Brillo pads can be used, they tend to leave a soapy layer behind, which then needs to be washed off. Soap-free wire wool can easily be obtained from your local DiY shop, **Fig. 4**. Make sure that you don't leave any strands of wire behind to short out the tracks on the board. Also be careful to keep wire wool or Brillo pads well away from battery terminals because they are so fine that they can generate a lot of heat and even fire if they short out battery terminals. Cleaning a PCB can be done while the soldering iron is warming up.

Maplin sell an Abrasive Fibreglass Pencil, order code KR61R, that is very effective for cleaning printed circuit board tracks, **Fig. 5**. It costs more than wire wool but it's much more controllable when cleaning small pieces of track. Maplin also sell a Polishing Block, Order Code HX04E at £4.99.

Most component leads won't need any preparation unless they have been sat in your junk box for years. If you have any doubts, a quick gentle twist of some wire wool will easily remove any oxide.

Fig. 5: An abrasive fibreglass pencil can be useful for cleaning a small area of a PCB.

Tinning the Leads

Just as we tinned the tip of the soldering iron, we also need to tin the leads of the component to be soldered. Bring the soldering iron and the solder up to the lead in question, allowing the solder to melt and flow into a very thin layer of solder along the lead. Do this for each of the leads on the component. Now insert the leads into the correct hole in the PCB.

The Joint Itself

To make the joint itself, bring the soldering iron tip and some solder up to the joint simultaneously. Melt the solder and the joint, and wait while the solder flows around the joint. This will take perhaps three to five seconds. Don't just dab the soldering iron on to the joint. It is really important for the solder to flow. Once the solder has flowed, remove the iron and return it to the stand. Now let the joint cool for at least 30 seconds. Very gently try moving the component (which might still be quite hot). Make sure that you cannot move it. If it doesn't move, then you've made a good joint.

Dry Joints

Once you have soldered a joint, and you find the component lead moves, then you have what is known as a dry joint. You'll need to re-heat the joint, apply a little more solder and wait for it to flow. If it still won't flow, then most likely you have an oxidised lead or PCB or the temperature of the soldering iron isn't high enough for the solder to really flow or perhaps you didn't leave the iron on the joint for long enough. Once you have a good joint, use some small side cutters to snip off the excess lead sticking through the PCB, **Fig. 6**.

Practice

If you are new to soldering, or haven't soldered for a few years, I suggest practising with a few odd components and a bit of Veroboard or an old PCB.

Fig. 6: Using side snips to remove excess lead.

PL259 Connectors

Soldering PL259 plugs is a bit of a challenge. While a 25W soldering iron is sufficient to solder the centre coax to the pin, the screen is a real challenge. There is simply too much metal to heat up to the melting point of solder for a 25W iron to cope with. Many PL259 plugs have a hole through which you are expected to solder the screen, **Fig. 7**. Realistically a 25W soldering iron isn't powerful enough.

In practice I think there are only two ways to do this. One is to use a much more powerful soldering iron, having filed the plug across the hole so that it is really clean and shiny. Personally, I much prefer to use the more expensive pressure sleeve types of PL259s, **Fig. 8**, where the screen is attached in a similar way to BNC and N connectors. These clamping types provide a near waterproof arrangement. I would certainly recommend using the pressure sleeve versions on all outdoor connections and ideally on indoor connections as well.

Removing Components

Sooner or later there will come a time when you'll want to remove a component from a PCB. Perhaps you've put a component in a wrong place on the PCB or round the wrong way, maybe you've decided that a component is faulty and needs to be replaced or you want to check it out of circuit.

My preferred method is to remove as much of the solder from the joints as I can by use of a soldering iron and solder sucker, **Fig. 9**. A solder sucker is a bit like a bicycle-tyre pump but in reverse. You press the spring-loaded piston in until it clicks. Then you heat the joint and press the button, which will free the piston to jump back, sucking the molten solder with it. You may need to repeat this process several times until as much of the solder has been sucked up as possible.

Once most of the solder has been removed, place a small screwdriver tip under the component and while heating the joint, gently apply pressure to lever the component up. Repeat this process for each of the component leads. This approach generally works quite well with two- or three-lead components. For multi-pinned components such as integrated circuits, I recommend using integrated circuit sockets, which are usually a lot cheaper than most integrated circuits and make removal so much easier!

Fig. 9: A solder sucker helps to remove solder from a joint before removing a component.

Fig. 7: A traditional PL259 plug with a hole to solder the screen with a high-power soldering iron.

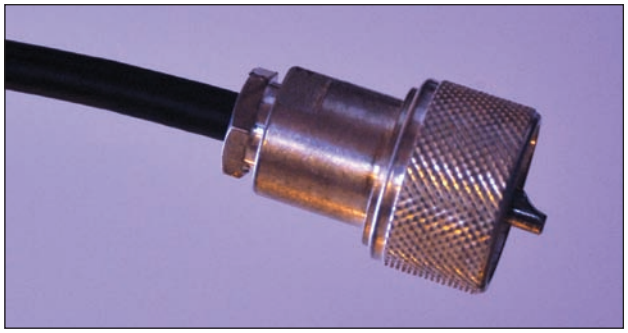

Fig. 8: Pressure clamp PL259 plug, which removes the need to solder the screen and provides better protection against moisture.